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10/045,007	01/15/2002	Ilan Beer	BEER=4	2713

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EXAMINER

MITCHELL, JASON D

ART UNIT PAPER NUMBER

2124

DATE MAILED: 03/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/045,007

Applicant(s)

BEER ET AL.

Examiner

Jason Mitchell

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 15 January 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-36 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-36 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 3/20/02.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

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### **DETAILED ACTION**

1. This application claims priority to U.S. provisional application 60/261,539 filed on 1/15/01.
2. Claims 1-36 are pending in this case.

#### ***Requirement For Information - 37 USC § 1.105***

1. Applicant and Assignee of this application are required under 37 CFR 1.105 to provide the following information that the Examiner has determined is reasonably necessary to the examination of this application.
3. 2. A publication date for reference AA "Model Checking SMV", listed as reference 'AA' in the information disclosure statement received June 12, 2002, is required; further Applicant must address the difference in authorship between "Model Checking SMV" (C. Eisner) and the instant application (I. Beer and C. Eisner).

The Examiner has attempted to locate a copy of the reference, but was unsuccessful. The earliest date this reference was published must be established in order to determine the reference's prior art status under 35 U.S.C. 102.

This requirement is made with the intent to assist in the prosecution of this case.

The Examiner feels the scope of this requirement is narrow and should be well within the abilities of the concerned parties to provide this information.

Where applicant does not have or cannot have readily obtained items of required information, a statement that the item is unknown or cannot be readily

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obtained will be accepted as a complete response to the requirement for that item.

The fee and certification requirements of 37   C.F.R. 1.97 are waived for those documents submitted in reply to this requirement. This waiver extends only to those documents within the scope of this requirement under 37   C.F.R. 1.105 that are included in the applicant's first complete communication responding to this requirement. Any supplemental replies subsequent to the first communications responding to this requirement and any information disclosures beyond the scope of this requirement under 37   C.F.R. 1.105 are subject to the fee and certification requirement of 37   C.F.R. 1.97.

This requirement is subject to the provisions of 37 C.F.R. 1.134, 1.135 and 1.136 and has a shortened statutory period of 2 months. EXTENSIONS OF THIS TIME PERIOD MAY BE GRANTED UNDER 37 CFR 1.136(a).

### ***Claim Objections***

4. **Claims 7, 19 and 31 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim.** Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Examiner does not recognize any functional difference between claims 7, 19 and 31 and their respective parent claims 6, 18 and 30. A stack pointer is inherent in the use of stacks, and generally one skilled in the art of data structures would use the two terms interchangeably. Without some

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specific disclosure of a distinction between the child and parent claims, Examiner is inclined to consider them equivalent, and therefore not further limiting.

***Claim Rejections - 35 USC § 101***

5. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

**Claims 1-12 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.** The Language of the claim raises a question as to whether the claim is directed merely to an abstract idea that is not tied to a technological art, environment or machine which would result in a practical application producing a concrete, useful, and tangible result to form the basis of statutory subject matter under 35 U.S.C. 101. Claims 1-12 recite a method for verifying software source code comprising: processing the source code, replacing references to program variables with non-deterministic choices, restricting the next-state functions, and verifying the finite-state model, but fail to recite embodiment in a computer readable media and therefore fail to recite statutory subject matter.

***Claim Rejections - 35 USC § 102***

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6. The following is a quotation of the appropriate paragraphs of 35

U.S.C. 102 that form the basis for the rejections under this section made in this

Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

**7. Claims 1-11, 13-23 and 25-35 rejected under 35 U.S.C. 102(b) as being anticipated by US 5,481,717 to Gaboury.**

**Regarding Claims 1, 13 and 25:** Gaboury discloses verifying software source code that includes references to program variables, the method comprising: processing the source code to derive a set of next-state functions representing control flow of the source code (col. 7, lines 62-65 'transition function f'); replacing the references to the program variables in the source code with non-deterministic choices in the next-state functions (col. 7, lines 37-41 'types are ... the set of possible terms that variables can take on'); restricting the next-state functions including the non-deterministic choices to produce a finite-state model of the control flow (col. 8, lines 8-10 'Conversion of a logic program to a canonical FSM form involves a number of steps which eliminate the structure implicit in the notation'); and verifying the finite-state model to find an error in the source code (col. 12, lines 42-43 'the equality between the first FMS and the second FMS is determined').

**Regarding Claims 2, 14 and 26:** The rejection of claims 1, 13 and 25 are incorporated respectively; further Gaboury discloses that processing the source code comprises extracting a program counter from the source code (col. 11, lines

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34-38 'Enumeration of the states'), and expressing the next-state functions in terms of the program counter (col. 11, lines 34-38 'of the state occurring in the transition function').

**Regarding Claims 3, 15 and 27:** The rejection of claims 2, 14 and 26 are incorporated respectively; further Gaboury discloses that processing the source code further comprises expressing the next-state functions with reference to a stack pointer associated with a stack used in running the code (col. 9, lines 6-8 'a limit of three has been placed on the number of elements that can be pushed onto the stack'), and wherein replacing the program variables comprises eliminating substantially all the references to the program variables from the next-state functions (col. 8, lines 25-30 'atomic formulae ... for each  $i=1...n$ '), leaving the next-state functions dependent on the program counter (col. 8, lines 25-30 'for each  $i=1...n$ ') and on the stack pointer (col. 8, lines 25-31 'atomic formulae ... for each ...  $j=1...m$ ').

**Regarding Claims 4, 16, and 28:** The rejection of claims 3, 15 and 27 are incorporated respectively; further Gaboury discloses that restricting the next-state functions comprises limiting the stack pointer to a value no greater than a predetermined maximum (col. 9, lines 6-8 'a limit of three has been placed on the number of elements that can be pushed onto the stack').

**Regarding Claims 5, 17, and 29:** The rejection of claim 1, 13 and 15 are incorporated respectively; further Gaboury discloses replacing the program variables comprises eliminating the references to the program variables from the next-state functions, so that the finite-state model is substantially independent of

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data values of the program variables (col. 8, lines 25-30 'atomic formulae ... for each  $i=1...n$ ').

**Regarding Claims 6, 18 and 30:** The rejection of claim 1, 13 and 15 are incorporated respectively; further Gaboury discloses processing the source code further comprises expressing the next-state functions with reference to a stack used in running the code (col. 8, lines 25-31 'atomic formulae ... for each ...  $j=1...m$ '), and wherein restricting the next-state functions comprises limiting the stack to a depth no greater than a predetermined maximum (col. 9, lines 6-8 'a limit of three has been placed on the number of elements that can be pushed onto the stack').

**Regarding Claims 7, 19 and 31:** The rejection of claim 6, 18 and 30 are incorporated respectively; further Gaboury discloses expressing the next-state functions comprises expressing the next-state functions in terms of a stack pointer associated with the stack (col. 8, lines 25-31 'atomic formulae ... for each ...  $j=1...m$ '), and wherein limiting the stack comprises limiting the stack pointer to a value no greater than the predetermined maximum (col. 9, lines 6-8 'a limit of three has been placed on the number of elements that can be pushed onto the stack').

**Regarding Claims 8, 20 and 32:** The rejection of claim 7, 19 and 31 are incorporated respectively; further Gaboury discloses expressing the next-state functions in terms of the stack pointer comprises incrementing the stack pointer in response to a function call in the source code (col. 6, lines 2-6 'pushed on the stack during a push operation'), up to the predetermined maximum (col. 9, lines



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6-8 'a limit of three has been placed on the number of elements that can be pushed onto the stack'), and decrementing the stack pointer when the function returns (col. 6, lines 2-6 'the element popped').

**Regarding Claims 9, 21 and 33:** The rejection of claim 1, 13 and 15 are incorporated respectively; further Gaboury discloses verifying the finite-state model comprises checking the finite-state model against a specification using a model checker (col. 12, lines 42-43 'the equality between the first FMS and the second FMS is determined').

**Regarding Claims 10, 22 and 34:** The rejection of claim 9, 21 and 33 are incorporated respectively; further Gaboury discloses restricting the next-state functions comprises automatically producing the model from the source code in a form suitable for processing by the model checker (col. 2, lines 50-55 'FSMs which are suitable for verification may be obtained'), substantially without human intervention in deriving and restricting the next-state functions or in replacing the references (col. 3, lines 1-3 'eliminating the need for the user to determine the data types of the program').

**Regarding Claims 11, 23 and 35:** The rejection of claim 10, 22 and 34 are incorporated respectively; further Gaboury discloses checking the finite state model comprises checking the model against one or more formulas expressed in terms of temporal logic (col. 4, line 18 'compares two FMSs').

***Claim Rejections - 35 USC § 103***

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8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. **Claims 12, 24 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,481,717 to Gaboury in view of applicants admission of prior art techniques.**

**Regarding Claims 12, 24 and 36:** The rejection of claim 11, 23 and 35 are incorporated respectively; further Gaboury does not disclose the use of counter-examples to indicate an error, but does disclose displaying the result of the model comparison to a user (col. 12, lines 42-45).

Applicant indicates, in the background disclosure of the instant application, that providing a counter-example was a common method in the art at the time of the invention for providing this information (pg. 1, line 27-pg. 2, line 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to display a counter-example, as taught by Applicant (pg. 1, line 27-pg. 2, line 1), to the user as disclosed in Gaboury (col. 12, lines 42-45) in order to provide a user a method of 'understanding and remedying the design defect' as noted in the instant application (pg. 2, lines 1-2).

### ***Conclusion***

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10. **Applicant and the assignee of this application are required under 37 CFR 1.105 to provide the following information that the examiner has determined is reasonably necessary to the examination of this application.**

A publication date for reference AA "Model Checking SMV" is required; further Applicant must address the difference in authorship between "Model Checking SMV" (C. Eisner) and the instant application (I. Beer and C. Eisner).

11. The information is required to enter in the record the art suggested by the applicant as relevant to this examination in Applicant's Information Disclosure Statement.

This requirement is an attachment of the enclosed Office action. A complete reply to the enclosed Office action must include a complete reply to this requirement. The time period for reply to this requirement coincides with the time period for reply to the enclosed Office action.

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US 6,209,120 to Kurshan et al; "Model Checking Graphical User Interfaces Using Abstractions" by Dwyer et al.; "Model Checking Large Software Specifications" by Anderson et al.; Model Checking Software Systems: A Case Study" by Wing et al.; "Abstract Model Checking of Infinite Specifications" by Jackson; Abstract Interpretation: A Unified Lattice Model For Static Analysis of Programs by Construction or Approximation of Fixpoints" by Cousot et al.; Ensuring Global Termination of Partial Deduction while Allowing Flexible Polyvariance" by Martens et al.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason Mitchell whose telephone number is (571) 272-3728. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kakali Chaki can be reached on (571) 272-3719. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jason Mitchell  
2/07/05

  
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